

Disease Modifying Drugs for Multiple Sclerosis
Glatiramer Acetate (Copaxone® — Teva Neuroscience)
Interferon beta-1a (Avonex® — Biogen Idec)
Interferon beta-1a (Rebif® — EMD Serono)
Interferon beta-1b (Betaseron® — Bayer Laboratories)
Mitoxantrone (Novantrone® — EMD Serono, generic)
Natalizumab (Tysabri® — Biogen Idec)
AHFS 92:00, Unclassified Therapeutic Agents

The following table provides a brief comparison of the available disease modifying agents used to manage multiple sclerosis.

Table. Comparison of Disease Modifying Agents Used for Multiple Sclerosis¹⁻⁸						
Property	Glatiramer (Copaxone)	Interferon beta-1a (Avonex)	Interferon beta-1a (Rebif)	Interferon beta-1b (Betaseron)	Mitoxantrone (Novantrone)	Natalizumab (Tysabri)
Indications for Use						
Labeled Indications	Reduce frequency of exacerbations in relapsing remitting multiple sclerosis	Reduce frequency of exacerbations and slow physical disability in relapsing forms of multiple sclerosis. Clinical isolated syndrome	Reduce frequency of exacerbations and slow physical disability in relapsing remitting multiple sclerosis	Reduce frequency of exacerbations in relapsing forms of multiple sclerosis: <ul style="list-style-type: none"> relapsing remitting multiple sclerosis (RRMS) secondary progressive multiple sclerosis (SPMS) Clinical isolated syndrome	Reduce frequency of exacerbations and slow neurologic disability in: <ul style="list-style-type: none"> worsening relapsing remitting multiple sclerosis (RRMS) secondary progressive multiple sclerosis (SPMS) progressive relapsing multiple sclerosis (PRMS) Advanced hormone refractory prostate cancer Acute myeloid leukemia	Monotherapy: Reduce frequency of exacerbations and slow physical disability in relapsing forms of multiple sclerosis (for patients who had inadequate response or cannot take other therapy) Induce and maintain response and remission in moderate to severe Crohn disease (for patients who had inadequate response or cannot take other therapy)
Unlabeled Indications	None	Secondary progressive multiple sclerosis	Secondary progressive multiple sclerosis Clinical isolated syndrome	None	Acute lymphocytic leukemia Breast cancer Liver carcinoma Non-Hodgkin lymphoma Solid tumors (pediatric)	Combination use with glatiramer acetate or interferon beta for RRMS

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Dosing and Administration						
Route of Administration	Subcutaneous	Intramuscular	Subcutaneous	Subcutaneous	Intravenous	Intravenous
Dosing Frequency	Daily	Weekly	Three times weekly	Every other day	Every 3 months	Monthly
Administration Method	Patient self-administration	Patient self-administration or give at physician's office	Patient self-administration	Patient self-administration	Infuse over 5 to 15 minutes in clinic or hospital setting capable of preparing and administering chemotherapy	Infuse over 1 hour in clinic or hospital setting
Dose for RRMS (adults)	20 mg subcutaneous daily	30 mcg intramuscular weekly	22 mcg to 44 mcg subcutaneous 3 times weekly after gradual dose titration	250 mcg subcutaneous every other day after gradual dose titration	12 mg/m ² intravenous every 3 months	300 mg intravenous every 4 weeks
Availability, Storage, and Stability						
Generic available	No	No	No	No	Yes	No
Product Description and Package Size	Solution in prefilled, single-use syringes: 20 mg/1 mL	Lyophilized powder for reconstitution: 30 mcg/1 mL Solution in prefilled syringes: 30 mcg	Solution in prefilled, single-use syringes: 22 mcg 44 mcg Titration pack: six 8.8 mcg prefilled syringes and six 22 mcg prefilled syringes	Lyophilized powder for reconstitution: 300 mcg/1.2 mL	Multi-dose vials: 20 mg/10 mL 25 mg/12.5 mL 30 mg/15 mL	Single use vial: 300 mg/15 mL
Storage	Refrigerate. Excursions of room temperature permitted. Do not freeze. Protect from light.	Powder: Refrigerate; can store at room temperature for 30 days. Syringes: Refrigerate; can store at room temperature for 7 days. Do not freeze. Protect from light.	Refrigerate Can store at room temperature for 30 days. Do not freeze. Protect from light.	Room temperature Do not freeze.	Room temperature Do not freeze.	Refrigerate Do not freeze or shake. Protect from light

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Stability	Do not use beyond expiration date printed on cartons.	Use reconstituted product within 6 hours and store in refrigerator.	Do not use beyond expiration date printed on cartons.	Use reconstituted product within 3 hours and store in refrigerator.	Use reconstituted product immediately. Discard any remaining solution in vial. Store opened, undiluted solution for 7 days at room temperature or 14 days in the refrigerator.	Use reconstituted product within 8 hours and store in the refrigerator.
Special Populations						
Hepatic Dysfunction	No dosage adjustment.	No dosage adjustment. Severe hepatic injury can occur. Use caution when used in combination with other hepatotoxic drugs.	Initiate with caution in patients with active or significant liver disease or liver enzyme elevations ≥ 2.5 times normal.	No dosage adjustment. Severe hepatic injury can occur. Use caution when used in combination with other hepatotoxic drugs. Initiate with caution in patients with active or significant liver disease or liver enzyme elevations ≥ 2.5 times normal.	Avoid use in multiple sclerosis patients with hepatic impairment. For other diseases, initiate with caution and consider lower doses.	No dosage adjustment. Severe hepatic injury can occur. Stop therapy in patients with jaundice or elevated serum hepatic enzymes or bilirubin.
Renal Dysfunction	No dosage adjustment	No dosage adjustment	No dosage adjustment	No dosage adjustment	No dosage adjustment	No dosage adjustment
Pediatric patients	Not labeled for use in patients <18 years of age. Use for juvenile onset multiple sclerosis is based on descriptive studies.	Not labeled for use in patients <18 years of age. Use for juvenile onset multiple sclerosis is based on descriptive studies.	Not labeled for use in patients <18 years of age. Use for juvenile onset multiple sclerosis is based on descriptive studies.	Not labeled for use in patients <18 years of age. Use for juvenile onset multiple sclerosis is based on descriptive studies.	Not labeled for use in patients <18 years of age. Use to treat solid tumors is based on descriptive studies.	Not labeled for use in patients <18 years of age.

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Black Box Warnings	None	None	None	None	<p>Vesicant: severe tissue damage may occur if product extravasated. Never give by intrathecal, subcutaneous, intramuscular, or intra-arterial administration.</p> <p>Bone marrow suppression: do not give if neutrophil count < 1,500 cells/mm³, except in patients with acute nonlymphocytic leukemia.</p> <p>Cardiotoxicity: risk increases with cumulative lifetime dose (maximum dose is 140 mg/m² for multiple sclerosis). Manufacturer recommends evaluating left ventricular ejection fraction (LVEF) before each dose. Do not give to multiple sclerosis patients with LVEF < 50% or significant reduction in LVEF with previous dose.</p> <p>Increased risk of secondary acute myelogenous leukemia.</p>	<p>Increased risk of progressive multifocal leukoencephalopathy (PML).</p> <p>Monitor patient and stop therapy immediately if any sign/symptom suggests PML.</p> <p>Only prescribe to patients enrolled in the TOUCH program.</p>
Comments	None	Contains human albumin	Contains human albumin	Contains human albumin	Chemotherapeutic agent	Only available through restricted distribution program- TOUCH

References:

1. Avonex (Interferon beta-1a) IM injection [package insert]. Cambridge, MA: Biogen Idec, Inc; 2006, November.
2. Novantrone (mitoxantrone) injection [package insert]. Rockland, MA: EMD Serono, Inc; 2007, May.
3. Copaxone (glatiramer acetate) injection [package insert]. Kansas City, MO: TEVA Neuroscience, Inc.; 2007, November.
4. Betaseron (Interferon Beta-1b) for SC injection [package insert]. Montville, NJ: Bayer Healthcare Pharmaceuticals; 2007, October.
5. Rebif (interferon beta-1a) SC injection [package insert]. Rockland, MA: EMD Serono, Inc. and Pfizer, Inc.; 2008, April.
6. Tysabri (natalizumab) injection for intravenous use [package insert]. Cambridge, MA: Biogen Idec Inc and Elan Pharmaceuticals; 2008, October.
7. McEvoy GK, Litvak K, Welsh OH, et al, eds. *AHFS 2008 Drug Information*. Bethesda, MD: American Society of Health-System Pharmacists; 2008.
8. Micromedex® Healthcare Series [intranet database]. Version 5.1. Greenwood Village, Colo: Thomson Healthcare.

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